

## REPORT DOCUMENTATION PA

AD-A216 250

1a. REPORT SECURITY CLASSIFICATION Unclassified			1b. RESTRICTIVE MA.	
2a. SECURITY CLASSIFICATION AUTHORITY			3. DISTRIBUTION / AVAILABILITY OF REPORT Distribution Statement A Approved for public release; distribution unlimited.	
2b. DECLASSIFICATION / DOWNGRADING SCHEDULE				
4. PERFORMING ORGANIZATION REPORT NUMBER(S)			5. MONITORING ORGANIZATION REPORT NUMBER(S)	
6a. NAME OF PERFORMING ORGANIZATION Center for Naval Warfare Studies Strategy & Campaign Department		6b. OFFICE SYMBOL (If applicable) 30	7a. NAME OF MONITORING ORGANIZATION	
6c. ADDRESS (City, State, and ZIP Code) Naval War College Newport, RI 02841-5010			7b. ADDRESS (City, State, and ZIP Code)	
8a. NAME OF FUNDING / SPONSORING ORGANIZATION		8b. OFFICE SYMBOL (If applicable)	9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER	
8c. ADDRESS (City, State, and ZIP Code)			10. SOURCE OF FUNDING NUMBERS	
			PROGRAM ELEMENT NO.	PROJECT NO.
			TASK NO.	WORK UNIT ACCESSION NO.
11. TITLE (Include Security Classification) U.S. Strategic and Critical Materials Imports: Dependency and Vulnerability. The Latin American Alternative (U)				
12. PERSONAL AUTHOR(S) Jorge L. Colombo, Captain, Argentine Navy				
13a. TYPE OF REPORT Final		13b. TIME COVERED FROM TO	14. DATE OF REPORT (Year, Month, Day) 89 May 31	15. PAGE COUNT 50
16. SUPPLEMENTARY NOTATION The contents of this paper reflect the professional views of the author and are not necessarily endorsed by the Naval War College, the Department of the Navy, or the Argentine Government				
17. COSATI CODES			18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number)	
FIELD	GROUP	SUB-GROUP	United States material imports, strategic minerals, petroleum imports, supply sources, Latin American alternatives (Caribbean, Central & South America), strategic stockpiling, strategic and critical imported materials, United (cont.)	
19. ABSTRACT (Continue on reverse if necessary and identify by block number) In time of war or during a National Emergency, it will be necessary for the United States to minimize dependence on extrahemispheric supply. This paper examines the extent to which current suppliers of strategic and critical imported minerals and petroleum, received from outside the American Continent, could be superseded with Latin American sources, including Caribbean, Central and South America. The paper concludes that this substitution of trade would be a desirable course of action now, to be pursued in peacetime, not only for the U.S. but also for the Latin American States as well. This paper lists the strategic and critical imported materials for the U.S., and also identifies current supply sources; determines to what extent current supply sources could be replaced by Latin American ones; identifies major U.S. policy changes that would be required to make new trade arrangements suitable, feasible, and acceptable; proposes conclusions, which are related to the future of the U.S. strategic stockpiling and to the improvement of the Latin American sources of supply.				
20. DISTRIBUTION / AVAILABILITY OF ABSTRACT <input checked="" type="checkbox"/> UNCLASSIFIED/UNLIMITED <input type="checkbox"/> SAME AS RPT. <input type="checkbox"/> DTIC USERS			21. ABSTRACT SECURITY CLASSIFICATION Unclassified	
22a. NAME OF RESPONSIBLE INDIVIDUAL PETER A. RICE, Deputy Dir, Strategy & Campaign			22b. TELEPHONE (Include Area Code) 401-841-4208	22c. OFFICE SYMBOL 30A

Block 18 (Cont'd) States trade policy, Latin American trade policy, Latin American mineral and petroleum export potential.

Available For		
<input checked="checked" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>		
By _____		
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U.S. STRATEGIC AND CRITICAL MATERIALS IMPORTS:  
DEPENDENCY AND VULNERABILITY.  
THE LATIN AMERICAN ALTERNATIVE

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May 1989

Approved for public release;  
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89 12 29 008

## Abstract

### U.S. STRATEGIC AND CRITICAL MATERIALS IMPORTS: DEPENDENCY AND VULNERABILITY. THE LATIN AMERICAN ALTERNATIVE

In time of war or during a National Emergency, it will be necessary for the United States to minimize dependence on extrahemisphere supply.

This paper examines the extent to which current suppliers of strategic and critical imported minerals and petroleum, received from outside the American Continent, could be superseded with Latin American sources, including Caribbean, Central and South America.

The paper concludes that this substitution of trade would be a desirable course of action now, to be pursued in peacetime, not only for the U.S. but also for the Latin American States as well.

This paper:

- Lists the strategic and critical imported materials for the U.S., and also identifies current supply sources.
- Determines to what extent current supply sources could be replaced by Latin American ones.
- Identifies major U.S. policy changes that would be required to make new trade arrangements suitable, feasible, and acceptable.
- Proposes conclusions, which are related to the future of the U.S. strategic stockpiling and to the improvement of the Latin American sources of supply.

## TABLE OF CONTENTS

### U.S. STRATEGIC AND CRITICAL MATERIAL IMPORTS: DEPENDENCY AND VULNERABILITY. THE LATIN AMERICAN ALTERNATIVE

CHAPTER	PAGE
Abstract.....	ii
List of Tables.....	iv
I Introduction.....	
II The U.S. and Strategic Materials.....	
1. The Strategic Materials Stockpiling Act...	
2. Strategic Materials: U.S. Dependence on Imports.....	
III Latin America and the Substitution of Current Supply Sources.....	
1. Latin America Economy.....	
2. Latin American Sources.....	
IV The U.S. and the Required Changes in Policies	
V Conclusions and Recommendations.....	
APPENDIXES.....	
NOTES.....	
BIBLIOGRAPHY.....	

# LIST OF TABLES

TABLE	PAGE
1 Key Raw Materials: Uses and Sources.....	
2 Latin American external Debt and Inflation.....	
3 Bolivia: Mining Production.....	
4 Brazil: Mining Production.....	
5 Chile: Mining Production.....	
6 Cuba: Mining Production.....	
7 Jamaica: Mining Production.....	
8 Mexico: Mining Production.....	
9 Peru: Mining Production.....	
10 Venezuela: Mining Production.....	
11 Bauxite: L.America versus World Total.....	
12 Tin Concentrates: L.America versus World Total.....	
13 Columbium and Tantalum: L. America versus World Total.....	
14 Production of Crude Petroleum.....	
15 U.S.- Latin American Trade.....	
16 Global Resource Availability.....	

## CHAPTER I

### INTRODUCTION

The National Defense Stockpile Program (NDS) has had a long and stormy history since the 1930s. The program grew from U.S. experience in two world wars, and has since been structured to deal with predicted shortages of strategic materials in a conventional future war. The question for greatest debate seems to be centered on how much is enough. It is easy to understand, therefore, that criticism has been centered on conventional war as being improbable in an age characterized by nuclear weapons. However, critics have not proposed any viable alternative for a strategic stockpile.<sup>1</sup>

There is no standard definition of a strategic material, but most definitions state that the material must be necessary for producing military or essential civilian goods and services, and that requirements exceed domestic and foreign supplies. United States legislation refers to "strategic and critical materials", as those having an adverse effect on the civilian economy and defense industries if supplies were disrupted.<sup>2</sup> The Strategic and Critical Materials Stockpiling Act for the U.S. identifies some ninety materials in the Defense Material inventories as of September 1987. As shown in Table 1, at least fifteen minerals are considered as "key minerals", because the U.S. is over fifty percent import dependent.

This paper deals with that group of minerals and petroleum, and while all those minerals are essential to the domestic economy and national security, four of them have been referred to as "first tier" or "big four" strategic materials because of their widespread role and vulnerability to supply disruptions. <sup>3</sup> In this paper, special emphasis will be placed on these four minerals, which are chromium, cobalt, manganese, and platinum group metals.

From the beginning the NDS program has had two different views for protecting the industrial base from shortages of strategic materials during a major war. One method is the accumulation of a stockpile sufficient to cover shortfalls of supplies; the other is to expand the domestic output so to reduce them. <sup>4</sup>

To what degree might the Latin American countries contribute to the former option? What is their production capacity? Prior to WW II, Latin America was a significant producer of what were then considered strategic raw materials. The list was quite short--copper, iron, coal, lead, and tin. However, the minerals considered essential have changed, as have the shares of U.S. imports coming from Latin America. By the end of the 1970s, the share of Latin American exports of strategic raw materials to the U.S. declined, and that trend is continuing today; in general terms, the contribution of mining to the gross product of the Latin American region has been declining, and this paper will focus on the short list of those strategic materials which Latin American nations are producing. It accounted for about eight percent of the continent's industrial activity in 1982, as opposed to 12% in the 70s. 5

Is it at all possible to reverse these trends, in the midst of the worst economic crisis that has ever effected Latin America? This paper tries to propose the best solutions to change this negative tendency within the North-South regional context. The Americas, perhaps more than any other region in the world, need the attention of the United States to overcome an explosive situation, which is related to their external debt and underdevelopment. To some extent, an increase in trade could be a good starting point. 6

This paper will first specify the essential and strategic imported raw materials to the United States, identifying current supply sources. Then, it will determine the extent to which these sources could be replaced by Latin American ones. Finally, the paper will identify major U.S. policy changes that would be required to make the new trade arrangements workable. This last point will be necessarily limited in scope, and assumes that Latin American nations will welcome any change in U.S. policies increasing trade, and consequently contributing to their own development.



## CHAPTER II

## THE U.S. AND STRATEGIC MATERIALS

## 1. The Strategic and Critical Materials Stock Piling Act.

The Defense National Stockpile is a reserve of strategic and critical non-fuel materials that the United States would require in a national emergency for essential military, industrial and civilian needs. The government's goal is to keep enough on hand to sustain the United States for at least three years.

There are four major factors that make a mineral a strategic resource: first, the critical need for the mineral in defense or industry such that a prolonged interruption would result in catastrophic consequences; second, the lack of adequate domestic resources; third, the limited potential for developing substitutes; and fourth, the lack of alternative or more secure sources of supply. 1

The National Stockpile was created to solve this problem and was the result of the Strategic Materials Act of 1939 and the Stockpiling Act of 1946.

In 1981, President Reagan restructured the National Stockpile program. The president intended to transform the stockpile from an inventory of ores, metals and basic materials to a reserve that would include high-tech materials and high-purity metals. The present stockpile contains 93 materials, ranging from aluminum to zinc, valued at \$9.6 billion.

The government action that has most significantly impeded domestic mineral production has been the restriction of access to federal lands for mineral exploration and development. Currently the federal government owns approximately 732 million acres, or about one-third of the land in the United States. It also retains control over the subsurface mineral rights of an additional sixty-three million acres and has jurisdiction over approximately one billion acres of offshore lands on the nation's outer continental shelf.2

In addition to this, several laws regulate the mining of raw materials, promote the safety of miners and plant workers, and minimize the environmental and health impacts associated with mining operations.

While these laws have unquestioned social and economic importance, they impede domestic mineral production, and the final consequences are that the minimum processing time for approval of a prospective lease is seventeen months, and for a mineral lease and mining plant permit, three years. In addition to this law-related situation, there are other considerations linked to the raw materials supply problem, such as the availability of substitutes, the updating of world reserves, the changing nature of prices and technology and the modification of the structure of international demand of specific strategic materials. 3 The Congress has, for the first time in many years, undertaken the issue of U.S. minerals supply. During the hearing held in Washington D.C. on December 10, 1987, before the Subcommittee on Mining and Natural Resources of the House of Representatives, the National Strategic Materials and Minerals Program Advisory Committee proposed a summary of twenty two recommendations to diminish import dependence.4 To reduce dependence on foreign sources for critical defense materials, the Pentagon is offering help to U.S. industry, and despite congressional complaints of departmental inaction, in mid-July, 1988, it made public a long-awaited comprehensive study with nineteen recommendations designed to institutionalize departmental mechanisms to deal with the problem.5

The United States has the largest stockpile program in the industrial world. However, other industrialized nations have just begun to stockpile minerals, and that is the case with Sweden. The Swedish government does maintain, to some extent, stockpiles of nonfuel minerals for both strategic and economic purposes. The Japanese, French, and West German governments have also recently implemented very limited stockpile programs. However, while these countries are highly import dependent for their supplies, they maintain relatively small stockpiles. Consequently, even though the U.S. strategic stockpile program is intended exclusively for U.S. domestic consumption, it is not unlikely that during emergency situations U.S. allies will turn to the number one global power on earth for at least a few critical stockpile minerals--with such small stockpiles, Europe and Japan would not be able to fulfill their needs during a protracted war. And if that were the case, the potential contribution of Latin American nations to supply both the U.S. and its allies with minerals, could result in a significant increase in this endeavor. 7

## 2. Strategic Materials: U.S. Dependence on imports.

As previously stated, it is the intent of this paper to examine the extent to which current suppliers of strategic and critical materials received from outside the American Continent could be replaced with Latin American sources. This is particularly important considering that the U.S. has had at least three major disruptions in the supply of materials critical to the national defense.

The first of these took place in 1949, during the Soviet blockade of Berlin, when the Soviet Union stopped exporting manganese and chromium ore to the United States. The second was from 1966 to 1972, during the crisis with Zimbabwe; at that time, Zimbabwe stopped its exports of chromium. Recently, Zaire's production and exports of cobalt were seriously affected by a rebel invasion of mining provinces. 6

These facts are emphasizing the necessity of the analysis that follows.

As shown on Table 1, the U.S. is dependent upon foreign sources of supply for fifteen strategic minerals. Of these, the key minerals in which the U.S. is over ninety percent import dependent, are: bauxite, chromium, cobalt, columbium, manganese, platinum group metals, tantalum, and titanium. Furthermore, United States foreign dependence for these metals will increase rather than decrease, as strategic minerals become increasingly important in meeting the demands imposed by new technologies in the energy industry and in research programs covering the broad field of National Defense.

Of all these minerals, the first tier are considered to be chromium, cobalt, manganese and platinum group metals. They are the most critical, the veritable "Metallurgical Achille's heel" of the United States strategic mineral supply because they are vulnerable to supply interruption. 7

The summary that follows is the most current available information related to the "big four" minerals: 8

Chromium Is essential to stainless steel and superalloy production. The U.S. produces 8% of chrome ore. South Africa, with 84% of the world reserve base, produces 34 percent of the world's chromium. The Soviet Union, which

produces about 30 percent of the world's chromium, has about two percent of the reserve base. Imports of chromium were 59% from South Africa, 22% from Centrally Planned Economies (CPEs, includes the USSR, Eastern Europe, and China), and 11% from neighboring Zimbabwe and Brazil for the 1982 to 1985 period. There is not known substitute for chromium in stainless steels and high temperature resistant superalloys.

Cobalt Is necessary in some superalloys, particularly in jet aircraft engines. The U.S. does not produce cobalt, and is dependent on imports for 97% of its cobalt needs, with recycling of purchased scrap supplying the balance.

South Africa is not a cobalt producer. However, Zaire and Zambia to the North have 32% of the reserve base and combine for 68% of world production; they transport their cobalt through South Africa. Cuba is second only to Zaire with a reserve base of about 22%. The Soviet Union is a net importer of cobalt and has invested heavily in Cuban cobalt production.

Between 1982-1985, the U.S. imported about 40% of its cobalt needs from Zaire, 16% from Zambia, and 41% from Canada, Norway, Belgium, and Finland. Nickel can substitute for cobalt in superalloys, but the loss of performance properties is significant for military applications.

Manganese The principal use of manganese is in steel production, which accounts for almost 90% of United States manganese consumption.

No manganese ore is produced domestically. The last year of production of manganese in the U.S. was 1970, and today the country is importing 98% of its needs. Domestic recycling of manganese from scrap materials is insignificant.

South Africa, which has 71% of the world reserve base of manganese, produces only about 15% of world mine production. The Soviet Union on the other hand, has about 21% of the world's reserve base but produces about 41% of the manganese.

The U.S. obtained 30% of manganese from South Africa during the 1982-85 period, and 68% from Australia, Brazil, Gabon, and Mexico. There is no satisfactory substitute for manganese in its major application in steel production.

The Platinum Group Metals(PGM) The PGM include six metals which have similar properties. Since there is no significant production or reserves of PGM in Latin America, further analysis of this metal is not included. However, more detailed information concerning these metals may be found in Appendix 1.

The U.S. imports \$1.4 billion worth of these four critical minerals--chromium, cobalt, manganese, platinum group metals--each year. The U.S. depends on southern Africa's minerals for about the fifty percent of the "big four". Thus, a long-term cutoff of any or all of these materials has the potential for an economic and strategic crisis of greater proportions than the oil crisis of the 1970s. An embargo of South African minerals to the U.S. would affect millions of American jobs in the steel, aerospace, and petroleum industries, and could in effect shut down those industry groups. 9

This paper will deal not only with chromium, cobalt, and manganese, but also with the critical imports to the U.S. which are available from Caribbean, Central, and South American nations, provided they have a reasonable potential for mineral exploitation and trade.

As already mentioned, Latin America is presently suffering the most serious economic crisis in all its history. Is it possible to overlook this issue in the present analysis, and proceed disregarding the likely implications that this economic situation might have in improving the North-South trade? The first section of the following Chapter will summarize an answer to this question.

## CHAPTER III

## LATIN AMERICA AND THE SUBSTITUTION OF CURRENT SUPPLY SOURCES

## 1. Latin American economics

Today, Latin America consists of nations, small and large, democratic and autocratic, that share in common (among other things), economic despair and political vulnerability. To further explain, it may be unreasonable to analyze anything in relation to Latin America if these realities are not dealt with first. Any attempt to increase mineral exploitation in Latin America will face the necessity of new investment in a region where the economy has already been exhausted by inflation and foreign debt. In other words, it seems to be extremely difficult to call for the allocation of new capital in Latin America under current economic and political conditions. Therefore, the analysis of Latin American mining production will include a brief summary of the region's economy, as a step leading to a better understanding of the overall problem and likely solutions.

Latin American and Caribbean nations have attained a level of development that has placed them at a disadvantageous position when compared with the more industrialized nations of the world. Between the sixties and the end of the seventies Latin America expanded faster than the U.S. and other nations. However, since the beginning of this decade there has been a sharp reversal, comparable to that of the Great Depression.

The region has more productive land that could be used for crop cultivation and mining exploitation than any other place in the developing world. However, the contribution of agriculture and mining to the region's GDP dropped from 21% in 1960 to 14% in 1983, and to 11% in 1987; these backward motions in the Latin American economy were direct results of the economic crisis. Since the problem of servicing the external debt surfaced in 1982, the region's economic and social development has been sharply reversed, and the origins of this Latin American problem are to be found in a complex set

of interacting factors, such as the rise of a large offshore international banking system, the slowing in the growth of world trade, and the rapid variation of petroleum prices in the 1970s.

The financing of Latin American economic deficits produced a fast increase in the region's external debt. By 1979 the international economic activity declined, reducing exports earnings, and as a natural consequence international interests began to rise. At the same time, this was followed by an important decline in private capital flowing into Latin America. All the economic inputs to the Latin American economic system were negative ones. Thus from 1982, the whole region experienced a debt service crisis, which was accompanied by a reversal of the economic progress of the preceding twenty-five years.

Regional Gross Domestic Product (GDP) increased by an annual average of 5% in 1974-81, but it declined by one-percent in 1982, and by a further 3% in 1983. The per capita income in Latin America fell by nearly 10% in 1982-87, and exports earnings also decreased. The region's external debt increased more than four times between the end of 1975 and 1988, from US \$90 billion to US \$405 billion. Since the end of 1982 Latin America has paid around \$235 billion in interest, but its indebtedness has increased by \$50 billion. Latin America, an underdeveloped region, has become a net exporter of capital.

Drastic economic adjustments resulted in the lowering of living standards and high economic insecurity, both exacerbating political and social tensions. Latin American inflation accelerated, from 85% in 1981 to 176% in 1984. Stagflation, a new word in economics first applied during Carter's term in office, is often used south of the Rio Grande, since it can be employed to define the worst combination of negative economic factors--stagnation plus inflation.

Besides affecting Latin America, the Latin American debt crisis is having a major impact on the U.S. economy. According to a wide variety of experts, it is increasing the U.S. trade deficit--both with Latin America and with U.S. trading partners, slowing the rate of U.S. economic growth, reducing the number of new jobs in the U.S. economy, increasing the rate of unemployment, and helping to increase the value of the dollar.

In many minds, the rising of U.S. trade deficit is associated with unfair Japanese trade practices. This views ignore the fact that Latin America,

not Japan, is the largest single contributor to the increased trade deficits the U.S. has experienced in recent years, and that there is an immediate and strong correlation between the Latin American debt crisis and the rising U.S. trade deficit. Seventy percent of the world decline in U.S. overseas sales can be attributed to falling demand in Latin America, and 55% of Latin America's import reduction came at the expense of U.S. producers. 1

The following section will analyze current of potential Latin American capacities in relation with mining and extraction industries. As already mentioned, any attempt to improve these capabilities, and consequently improving the North-South trade, should be inscribed within the referential frame of Latin American inflation and stagnation.



## 2. The Latin American Sources

Some Latin American nations have a reasonable potential for mineral exploitation and trade. Countries like Bolivia, Brazil, Cuba, Jamaica, Mexico, and to some extent Chile, Peru, and Venezuela, are already exploiting and exporting raw materials within Latin America, applying different models of regional economic integration and trade; in some cases, a part of these mineral outputs were exported to the United States. In 1985, for example, Brazil, Mexico, and Venezuela exported aluminum to the U.S.; the same year, the U.S. imported from Brazil ferrochromium, chromite, columbium, tantalum, manganese, and titanium.

This section will provide an analysis of the Latin American production capacity for minerals and petroleum. The Latin American region produced about one-eighth of the value of all non-fuel minerals in the world in the early 80s. Their mines produced about a quarter of the world's antimony and silver, one-sixth of its tin and copper, one-seventh of iron ore, zinc, bauxite and molybdenum, and one-tenth of its tantalum, tungsten, and lead. The very selective group of nations producing some of the "big four" minerals (chromium, cobalt, manganese, and platinum group metals) includes only two Latin American countries--Brazil and Cuba.

According to available information, and based on other proven capacities of production, or on current estimated reserves, the list of Latin American nations considered to have potential for increased trade with the United States are: Bolivia, Brazil, Chile, Cuba, Jamaica, Mexico, Peru, and Venezuela. This potential is analyzed in Appendix 2, and summarized in Table 15.

The analysis that follows embodies the production of strategic materials (non-fuel and petroleum) in Latin America, compared to the rest of the world.

### Production of Cobalt

About 31,500 short tons of cobalt were produced in the world during 1987, of which 1,500 were produced in Latin America. Cuba is the only L.American producer. Latin America accounted for the four-percent of the world total.

### Production of Manganese

The world total during 1987 was 24.6m short tons. Brazil, the only significant producer of manganese ore in Latin America, had an output of three million tons, or 12% of the world total. Chile and Mexico, with small amounts, may become significant producers in the future.

### Production of Bauxite (Table 11)

Latin America produces about 22% of the world total of bauxite. Jamaica and Brazil are the most important producers in the continent.

### Production of Chromium

The world total during 1987 exceeded 10m short tons, of which Latin America produced about 4%; Brazil and Cuba were the only regional producers of chromium ore. However, Cuba has large reserves, estimated to contain more than 10m tons, and Cuba's potential production capacity remains 100,000 tons per year.

### Production of Tin Concentrates (Table 12)

Latin America produces almost one-fourth of the world total of tin ores, or 41,000 metric tons. The leading regional producer is Bolivia, and Brazil is the second Latin American producer.

### Production of Columbium and Tantalum (Table 13)

In 1985 Latin America produced almost 85% of the world's columbium and tantalum mineral concentrates. Brazil was the solitary regional producer.

### Production of Titanium

About 5.4m short tons of titanium concentrates (ilmenite, rutile, leucoxene, and titaniferous-slag), were produced in the world during 1987. Brazil is the only Latin American producer of rutile and titanium oxide. Brazil reportedly processed 3m short tons of minerals containing 20% titanium oxide in 1987, which gives to the region 12% of the world total.

In 1986, Latin America contributed to the world production of petroleum with ten-percent of the total output. Mexico and Venezuela are the largest producers in the region. Latin America accounts reserves for more than 85b. barrels; this amount places Latin America third in the world, after Saudi Arabia and Kuwait.

The substitution of current supply sources with Latin American ones means improving trade with one of the poorest regions in the Free World, and for such a change to occur it must pass tests of suitability, feasibility, and acceptability. There is also in this particular case that of politics, a labyrinthian issue which is always present in analyzing North-South relations. The analysis that follows tries to summarize these sensitive questions.

## CHAPTER IV

## THE UNITED STATES AND THE REQUIRED CHANGES IN POLICIES

As may be seen in table 1, the U.S. is already importing raw materials from several Latin American countries. However, the potential capacity of the region as an alternative source is still far from being totally explored in peacetime, as a necessary step to ensure these sources in case of war. At the very core of the discussion, the question at issue could be vital for the security of the U.S.: the Latin American alternative sources will be more secure sources of supply than the rest, only if the U.S. proceeds through a new set of policies, directed to be applied in a highly complex and extremely grave regional context.

Of all the world's sub-regions, Latin America (especially South America), is the most often underestimated, principally because it is so far away from any strategic frame of reference, and beyond the more complex and conceivable volatile areas of the world. The relative calm in South America--an area where only two important wars have occurred in the past 100 years; the scarcity of firm footholds by the superpowers in the area; and its underlaying demilitarized status (no important military base South of Panama)--all have compelled the U.S. to focus attention elsewhere, simply because it presents no major threat to the tranquility of the Continent. It is a policy that has lead to isolationism and to a lack of communications between the U.S. and L. American nations. 1

By analyzing the formidable gap between realities, trends, and perceptions, that influence communications between Latin American nations and the rest of the world, mainly with the United States, the complex dynamics in North-South relations should be brought to light. It in part explains the inability of the major powers to develop a coherent and stable policy with Latin America. It seems to be that the industrialized North, especially the West, does not perceive Latin American countries as acceptable partners in political interactions. This "nonrecognition" creates an obscure void, and works against the industrialized nations of the North setting up reliable communications with the South.

The following considerations should be a part of any rationale, as a starting point in the analysis of eventual changes in the U.S. policy regarding Latin America.

- Latin American interactions in the economic and political fields usually develop in line with the U.S. and with the European countries of the West. If this general pattern is broken, it is more a consequence of a rupture in communications than a tilting toward extraregional powers, such as the Soviet Union, Japan, or China. It is the need for technology and development which has stimulated Latin America to look for new alliances and markets, when these necessities were not totally fulfilled by the West. Example: Peru-USSR relations. 2

- Original "Americanist" conceptions that amalgamated (at least morally) the hemisphere, gave way to an isolationist policy from and toward Latin America, and the need to communicate began to dissipate. Left alone, Central and South American countries started to look inward, and geopolitical concerns gained preeminence, since their interactions tended to be more within the southern region of the American continent than outside it. Not only the Monroe doctrine is at stake, but also the necessity of organizations such as the Organization of American States and regional treaties as the Inter-American Treaty of Reciprocal Assistance. 3

Out of the mass of political and economic problems that may affect any intended change in relations between the U.S. and Latin America, the Latin American external debt emerges as the acknowledged leader. However, every change in courses of action trying to match the newly assigned policies, with the available political means, and assuming that the probable results are worth the estimated costs, should at least take into consideration another factor: the North American Multinational Corporations. This is an extremely sensitive issue, that should be considered of high priority by the U.S., in order to actually improve the trade with Latin America. The brief analysis that follows tries to demonstrate to what extent it could be necessary for the U.S. to adjust its economic policy regarding the operation of multinational corporations, in the assumption that they are the most visible vehicle for the regularization of the Latin American economic system and trade.

- Over the years, the structure of American investment in Latin America has changed. During the 1960s, for instance, American enterprises allocated more heavily in manufacturing than in extractive operations, which resulted in damaging the future of mining industries in Latin America. By 1985, 41% of American direct investment was in manufacturing industries, compared with 35 percent in 1960. From 1960 to 1985, the share of investment in extractive industries decreased from 43% to 25%, thus diminishing the production of raw materials in Latin America. 4

- The potential for conflict between host states and parent states has been particularly increased and exacerbated regarding the economic relations and trade with Latin American nations, because of a substantial difference in objectives for the same multinational enterprise.5

- The U.S. and L. American countries had in the past disagreed about measures taken to influence de conduct of multinational corporations, and this was projected precisely on the field of mining and raw materials. The efforts of Peru, Bolivia, and Chile, to nationalize American business enterprises in recent years, have caused important conflicts in official governmental relations between these countries and the U.S. This heightens anxiety and mistrust than multinationals are instruments for United States foreign policy attempts. 6

However, as the economies of different nations have become increasingly tied and functionally interdependent, the multinational corporations seems to have been best able to assimilate to a transnational style of operation. At least, they have a satisfactory international perspective and efficiency, and they are above the normal average of most of domestic governmental institutions. If properly administrated, they are an adequate means for transnational interactions and relationships. 7

Any effort to increase trade between the U.S. and L. America means coping with a very complex situation, both economic and political. This requires changes in policies in both sides, and the appropriate vehicle could be the multinational corporations, operating through a set of new policies,

investing more in extractive operations than in manufacturing, and trying to be more a solution than the object or source of new conflicts. In relation with the foreign debt, developing nations face a huge negative transfer if they continue to service their obligations, and this will most likely be politically unsuitable. The debtor's export potential is diminishing, thus indirectly reducing the creditor's capabilities. In any case, this is too a vast issue to be totally developed in the present analysis. Therefore, the following proposals will be necessarily narrow in scope, regarding the broad spectrum of eventual changes in policies.

Suitability The multinational corporations are the appropriate vehicle to accomplish any proposed changes in policies between the U.S. and Latin America, regarding the improvement in raw material's trade. Within current or future economic and political context, of which the Latin American foreign debt is a part, the apparent suitable organization could be the integrated international enterprise. 8

Feasibility In the above mentioned structure, the probability of competition with the host state is great. However, the action of these corporations may be carried out only if the source of such conflict comes from the unquestionable national character of the firm, not from its foreign, ethnocentric nature. Increasingly, multinational enterprises are tending to take on the characteristics of this type of organization; the more progressive and successful U.S. multinationals are consciously trying to improve a worldwide approach to business in more realistic terms, and this may be the case with American mining enterprises investing new capital in Latin America. 9

Acceptability For the U.S. and Latin American nations, the required changes in policies will be acceptable if the probable results are worth the estimated costs, both political and economic. In the present case, and due to the particular nature of one of the involved parties, Latin America, the costs are difficult to predict.

What could be acceptable to the U.S. should also be acceptable to Latin America. This acceptability will be related to the overall picture of a

strong perception that the ordinary Latin American generally share: anti-Americanism, a profound and complex distrust of the United States. In many respects, anti-Americanism is rooted in an irrational, Freudian transfer of responsibility for the actual and supposed maladies of Latin America. As the Peruvian novelist Mario Vargas Llosa puts it: "One of our worst defects--our best fictions--is to believe that our miseries have been imposed on us from abroad, that others have always had the responsibility for our problems." 10

The required changes in U.S. policies should include a better understanding of Latin American problems, and the appropriate use of multinational corporations, which seems to be the suitable vehicle to accomplish any proposed changes regarding the improvement in raw material's trade. Enterprises should be organized in such a way to promote regional objectives taking into account both Latin American and U.S. interests; Latin America must contribute with an authentic plan of reform, because it makes no sense to have a substantial growth in state sectors, and a tradition of government involvement in economic affairs south of the Rio Grande long after it has been repudiated in the communist world. 11



## CHAPTER V

## CONCLUSIONS AND RECOMMENDATIONS

Conclusions

1. As shown in Table 16, the earth's resources are not infinite; thus, they are potentially exhaustible, and depletion of known world resources may become a reality in fifty more years.

Many areas of Latin America have not been explored for mineral potential. Important mineral resources are estimated to exist in the Antarctic region, the South Atlantic Ocean, Bolivia, Brazil, Chile, Cuba, Jamaica, Peru, Venezuela, and Mexico.

2. The U.S. is currently dependent on a few producing nations for most of its strategic materials. Some of these countries (i.e. South Africa, the USSR) are either politically unstable or even hostile to the U.S.; as a direct consequence, supply disruption is most likely to occur. It is imperative to expand the number of countries providing these minerals, in order to obtain a greater supply heterogeneity.

3. In Latin America there are fuel and non-fuel minerals. However, the potential capacity of the region as an alternative source of raw materials for the U.S. is still far of being completely explored and exploited. The vital flow of most strategic raw materials could be maintained by making a wider use of the Latin American production capacity.

Latin American countries cannot afford, by themselves, the expansion of mining industries, due to extremely grave economic circumstances; Latin America needs new investment contributing to its overall development, and this includes the enhancement of extraction enterprises.

Under present conditions, Latin America is not a significant nor a dependable furnisher for the United States; nevertheless, this situation can be reversed through an adequate set of coherent policies, transforming Latin American countries in reliable allies.

Recommendations

1. The intended changes in courses of action should be suitable, feasible, and acceptable for both the U.S. and Latin American nations. This means that U.S. policies for Latin America should tend to Latin America development. In the case at issue, the multinational or transnational corporations should develop mining industries, by means of the integrated international enterprise. In so doing, the U.S. would be developing comprehensive policies to protect itself in the event a disruption in the provision of strategic and critical materials occurs.

2. A hostile Latin America--currently a source of illegal immigration, drugs traffic, and political and financial instability--will sooner or later request United States' attention to the Rio Grande.

Latin America is the region of the underdeveloped world with which the United States has the closest cultural and historical affinity. Development in dynamic countries as Argentina, Brazil, Chile, and Mexico is crucial for the development of the entire hemisphere, including that of the United States. A cooperative, imaginative relationship between North, Central, and South America is essential whatever assumption could be made regarding world's economy. From this perspective, new U.S. investment in Latin American mining industries could be both appropriate and beneficial.

In 1972, the late Leonid Brezhnev said while visiting Somalia: "Our aim is to get control of the two great treasure houses on which the West so vitally depends, the energy treasury house of the Persian Gulf and the mineral treasury house of Central and South Africa."

The Soviet leader was only partially right. His statement was incomplete--he failed to mention Central and South America, the forgotten regions in the West, as both an energy and mineral treasury. It was an admissible mistake for a Soviet official. Such an omission, however, should not be acceptable for any American leader.

## APPENDIX 1

### The Platinum Group Metals(PGM)

The PGM include six metals which have similar properties, and they are: platinum, palladium, rhodium, iridium, osmium, and ruthenium. They are essential to refining petroleum, and producing nitric acid for fertilizers, explosives, and other chemicals.

As with manganese, the principal producers of the platinum group metals are the Soviet Union and the Republic of South Africa. About 90% of the world reserve base of PGM is in South Africa, and another 9% is in the Soviet Union. This leaves only about one percent of the reserve base in the rest of the world. Currently, based on 1987 estimates, South Africa produces 48% of mined PGM, while the Soviet Union produces 46% and Canada 4%. these figures indicate that in the long run, South Africa will remain the predominant producer.

During 1982 to 1985, the United States received about 60 percent of its PGM imports directly from South Africa. At least 12% of U.S. imports were obtained from the Soviet Union, and 19% from the U.K., Canada, Belgium, Germany and Mexico.

There is little substitution possible for PGM in catalytic applications, and it is evident that the United States' dependency on both South Africa and the U.S.S.R for imports of platinum group metals is a matter of strategic concern.

## APPENDIX 2

### Latin American Potential for Increased Trade

#### Bolivia(Table 3)

Although mining contributed only 8% of Bolivia's GDP in 1983 and employed only four-percent of the economically active population, this industry has become fundamental to the external sector.

It can be divided into two categories: non-ferrous metals, which remain a major contribution to exports, and petroleum and natural gas. By the end of the 1970s Malaysia was the world's leading tin producer, and Bolivia was the second, but then this Latin American nation was replaced by both Indonesia and Thailand.

Bolivia, at a very high cost, is a good producer of tin, but its production has declined and presently is producing only 15% of world's total. As a consequence, the industry has started a new diversification looking for the production of other metals: lead, antimony, bismuth, and tungsten.

Oilfields are important in Bolivia. The peak of the petroleum production was in 1973, but fell ever since, and is presently hardly covering rising consumption requirements. New discoveries in the northern region of the country, estimated to be capable of producing 80,000 barrels per day, may change the future.

The most significant production of minerals in Bolivia is tin ore. This is a key raw material for the United States, and Bolivia accounts for more than one-half of the Latin American production. Bolivia is currently exporting tin to the U.S., and there is real potential for tungsten as well.

In 1985 Bolivia exported 26% of its total exports to the U.S., and imported 29% from the same country; in both cases the U.S. was Bolivia's major trading partner. Minerals are the main product of Bolivia's foreign commerce; in 1985 it accounted for 75% of its total exports. There is significant potential for increasing trade with the U.S., receiving in exchange consumer goods, raw materials and intermediate goods for agriculture, industry, and for construction; chemicals, industrial products and transport equipment.

Brazil(Table 4)

Mining accounts for only a rather small proportion of Brazil's GNP. However, it has a relevant place in exports. Brazil is the world's second largest exporter of iron ore, after Australia. Brazil is a significant producer of manganese; it also produces growing amounts of tin and copper, and the country is the world's third largest producer of gold. Brazil also has large bauxite deposits of about 4,600m. metric tons. In 1985, Brazil produced almost 85% of the world's columbium and tantalum mineral concentrates.

Brazil's petroleum sector underwent a total transformation that began in the early seventies, including the substitution of a substantial proportion of internal demand through the production of ethanol derived from sugar cane. Daily production of petroleum during 1987 stood at 590,000 barrels, with perhaps as much as 26,000m. barrels of reserves in the offshore fields. Brazil expects to be self-sufficient in energy during the 1990s. Following a series of delays and technical problems, the 657 Megawatts Angra dos Reis nuclear power station came into operation three years ago. Argentina and Brazil are the only two Latin American nations with nuclear-powered plants.

Brazil has significant reserves and production of manganese, bauxite, columbium, and tantalum. While these minerals are key raw materials for the United States, one of them, manganese, is included in the list of the "big four" strategic and critical minerals for the U.S.. Brazil's current production of manganese ore is twelve-percent of world's total. As for bauxite, Brazil is second only to Jamaica in Latin America, and accounts for seven-percent of world's total.

The United States is currently importing from Brazil aluminum and bauxite, ferrochromium, columbium, manganese, tantalum, and titanium concentrates. In exchange, Brazil receives from the U.S. consumer goods, intermediate goods, industrial machinery and chemicals. In 1985 Brazil exported 20.5% of its trade to the U.S., and imported 15% from the same country.

Brazil has the largest economy in Latin America. Therefore, Brazil probably has the highest potential for trade with the U.S. Other than minerals, Brazil is Latin America's largest producer of all types of goods and

industrial products, semi-manufactured and manufactured; this includes the aircraft industry, weapons systems, armour and artillery, military vehicles, infantry weapons and its shipbuilding industry.

Chile(Table 5)

Mining in Chile is, historically, a critical export item contributing for about ten-percent of GDP. The country's huge copper reserves are considered among the largest in the world. In 1982, with a production of 1,2m. metric tons, Chile easily became the world's number one producer of copper, and it accounted for almost one-half of Chilean exports by value. Chile is also producing and exporting other minerals: nitrate and salts, lead, coal, and iron. In small amounts, molybdenum and manganese. Altogether, the last group of minerals accounted for 11.8% of exports.

In recent years Chile has encouraged foreign capital to invest in copper and other minerals under the terms of the Mining Law of 1983, and many North American enterprises did so.

Chile has petroleum to cover only the fifty-percent of its internal demand. Total production in 1984 was 2.3m. cubic meters.

Chile's trade was mainly with the United States. In 1985, Chile exported 21% of its trade to the U.S., and imported 24%. Chile exported to the U.S. copper, vanadium, and molybdenum, and received in exchange industrial products and chemicals. Other than minerals, Chilean exports include wood, fruits, and vegetables, manufactured goods, and fish meal fodder. For these reasons, Chile's potential for trade is estimated to be high.

Cuba (Table 6)

Cuba has the fourth largest nickel reserves in the world. It is expected to complete two new Soviet-built plants which, when operational, are supposed to improve three times the total annual output of electrolytic nickel. The Soviets are the major export market of Cuban nickel and, as with sugar, exports of nickel to communist countries are arranged under long-term bilateral agreements and preferential prices.

Cuba has large reserves of chromium ore. However, in spite of these reserves, Cuba's annual production has been in permanent decline. Potential production capacity remains at 100,000 tons per year, and the Oriente province alone is estimated to contain 10 million tons of chromium ore reserves.

Cobalt extraction has been helped by the introduction of new techniques, and copper extraction has more than doubled, again owing largely to improvements in mining techniques coming from the USSR. Cuba also possesses substantial deposits of iron ore, manganese, lead and zinc, but they are not commercially exploited.

Cuba is import dependent on petroleum, about 98% of which is supplied by the Soviets, according to bilateral agreements tied to the exchange for Cuban sugar.

Regarding strategic and critical materials for the United States, Cuba is currently producing four-percent of the world's cobalt total, and it accounts for approximately 22% of known world reserves. Cuba also possesses substantial amounts of chromium, manganese, nickel, and zinc. Thus, Cuba's potential for trade is significant. However, the Cubans are trading with the East Block under bilateral agreements, and therefore it should not be reasonable to expect changes in their trade policy in the short term.

Jamaica(Table 7)

Jamaica has the largest production of bauxite in Latin America, and it was the third largest producer in the world in 1982, after Australia and Guinea.

Jamaica has a diversified economy, probably the most varied of the Commonwealth Caribbean, and its performance in the mining sector is measured primarily by the activity of the bauxite/alumina industry, representing more than 90% of the total value of production in the sector. Most of the enterprises operating in these industries are U.S. and Canadian companies.

Jamaica depends on imports of petroleum for all its needs, and petroleum exploration has not produced exploitable finds.

Bauxite constitutes a strategic and critical raw material for the United States, and Jamaica is currently exporting its mineral production to the U. S. (about 77% of its total trade in values). Due to its reserves of minerals, Jamaica has significant potential for increasing trade in the future.

Mexico(Table 8)

Mexico, together with Brazil, remains one of the most important mining countries in Latin America.

In 1983, when the new Real de Angeles mine came into production, Mexico regained its position as the leading producer of silver in the world. Also the same year, the country was producing one-sixth of the non-Communist production of silver.

During this century, copper, zinc, and lead came to the first line of production as well, and diversification is one of the key points to consider in analyzing Mexican production. Mexico may be divided into three main areas of production. The eastern region of the Gulf Coast and Yucatan have all type of metallic minerals. The central zone is producing silver, platinum, lead, and zinc. Finally, the western region is the major source of copper.

Petroleum has been a characteristic chapter in the history of Mexican



economy. Mexico was, in 1986, and it is still today, the world's sixth larger producer of crude oil, accounting for almost 2,5 million barrels per day. In 1985, Mexico had proven petroleum reserves of almost fifty billion barrels, which places Mexico number four in the world, after Saudi Arabia (168,9 billion barrels), Kuwait (89,8), and the Soviet Union (61.0). Mexico is self-sufficient in petroleum and its refined products, and in 1983 the nation exported approximately one-half of its total production, which in turn constituted 67% of Mexican exports in value. About 40% of Mexico's crude petroleum is now refined in the country, and a huge investment has been made to increase the capacity of existing refineries, and to operate offshore drilling platforms and processing facilities. This has resulted in a significant enlargement of the country's external debt, and PEMEX is responsible for at least 35% of Mexico's foreign debts. Mexico has reserves enough to guarantee current production level for at least 50 years, and is the leading producer of petroleum in Latin America.

Current trade between the United States and Mexico is very active, and its potential for growth in the future is very high. In 1988, Mexico exported 54% of its trade to the U.S., and imported 63%. Mexican exports to the United States included zinc, manganese, platinum, and crude oil; in exchange, Mexico imported from the U.S. all type of manufactured and semi-manufactured goods, automobiles and automobiles components, industrial machinery, chemicals, drilling machinery, and foods.

#### Peru(Table 9)

Peru's mining sector contributed 10% to GDP, or over 60% to total exports revenues in 1984. Mining is competing with fishing for first place in the country's exports.

The central region has historically been the most important, for silver ores have been mined at Cerro del Pasco since the 17th century. However, the area is today much more significant for zinc, lead, copper, and tungsten.

In 1983, Peru was the eight largest producer of copper in the world. Peru was the world's second largest producer of silver in 1984, and gold production, which was already important in 1984, was expected to increase by more than 25% in 1986. In 1983, zinc output placed Peru

fourth in the world production records, and the country was number five in the list of lead producers. At the same time, Peruvian production of tin has grown rapidly, multiplying by four the output between 1978 and 1983. The country is also a significant producer of molybdenum. National petroleum production supplies more than two-thirds of domestic needs. In 1984, the crude oil output was 183,600 barrels per day. Offshore drilling started in 1984, with great expectations that are not yet confirmed.

As with Mexico, current trade between the United States and Peru is very active. In 1987, Peru exported 33% of its trade to the U.S., and imported from the U.S. the same amount. Peru's exports to the U.S. included copper, lead, silver, molybdenum, zinc, tungsten, and tin (the last three minerals being of strategic value for the U.S.). In exchange, Peru imported from the U.S. all type of goods, industrial machinery, chemicals, and foods.

Peru has significant reserves of minerals. Therefore, this Latin American country has significant potential for increasing trade with the U.S. in the future.

#### Venezuela (Table 10)

This Latin American country is rich in both fuel and non-fuel minerals, with large reserves of petroleum, iron ore, gold, diamonds, silver, coal, and bauxite; to a lesser extent, there are deposits of nickel, zinc, lead, copper, and uranium as well. However, mining industries in Venezuela are in a state of development, and the non-petroleum mining sector contributes two-percent to the total GDP. Proven reserves of bauxite have been assessed at 500 million metric tons, which means enough to cover total world needs for at least seven years, and planned exploitation of recently discovered deposits forms an essential part of government plans for an integrated aluminum industry. Yet, petroleum still constitutes the main pillar of the Venezuelan economy.

The petroleum industry spearheads Venezuela's economy, accounting for more than 20% of GDP and almost one hundred-percent of total export earnings. Venezuela is currently ranking as the ninth largest petroleum producer in the world, and is placed immediately after the U.S., accounting for almost two million barrels per day. A high level of

investment in petroleum exploration and in the development of secondary methods of recovery during the 1970s increased the level of Venezuela's proven reserves to 29.3 billion barrels, placing Venezuela number nine in petroleum world reserves, again after the U.S. (35.4b. barrels). On the basis of current rate of extraction, Venezuelan reserves would be exhausted in approximately 45 years.

In spite of many efforts to diversify the export base away from the U.S., North America continues to receive more than 50% of Venezuela's crude oil exports. Of all OPEC's member countries, Venezuela is the largest refiner of petroleum, accounting for twelve operating refineries.

As was the case with Mexico, Venezuela also has a diversified base of minerals, but mainly accounts for vast reserves of bauxite. In 1987, Venezuela exported 42% of its trade to the U.S., and imported 46%. Venezuela's exports to the United States included crude oil, petroleum products, and bauxite. The United States exported to Venezuela all kind of goods and services, industrial machinery and equipment, drilling machinery, automobiles and automobile components, manufactured products, chemicals, and foods. In Latin America, Venezuela is second only to Mexico in trading with the United States. Due to its reserves of bauxite and petroleum, Venezuela has great potential for increased trade with the United States.

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TABLE 1 (Chapter I)

## KEY RAW MATERIALS: USES AND SOURCES

MATERIAL*	DEFENSE USE	CURRENT MAJOR SOURCES	ALT COMMERCIAL SOURCES**	U.S. % IMPORTS
1) Bauxite Aluminum	Aircraft, airframes, naval vessels	Australia, Jamaica, Guinea, Suriname	Brazil, Greece, Guyana	93
2) Chromium	Missiles, aircraft frames jet engines, stainless steel use in many weapons	South Africa, Zimbabwe Yugoslavia, Turkey	Brazil, India, Philippines	92
3) Cobalt	Jet engines, missiles	Zaire, Zambia, Canada Norway	Australia, New Caledonia Philippines	97
4) Columbium	Jet engines, steel alloys, armor	Brazil, Canada, Thailand	Nigeria, Zaire	100
5) Gallium	Electronics	Western Europe	Japan	62
4) Germanium	Fiber optics, infrared	United States, Belgium Luxembourg, Great Britain	France, West Germany	73
7) Manganese	Steel alloys, ships, armor, vehicles	South Africa, France, Brazil, Gabon	Australia, India	98
8) Nickel	Jet engines, missiles, stainless steel	Canada, Australia, Botswana, Norway	Colombia, Dominica, New Caledonia, Philippines	77
9) Platinum	Electronics	South Africa, Great Britain, Soviet Union	Canada	91
10) Common Silicon	Steel, aluminum alloys	United States, Brazil Canada, Norway, Venezuela	France	52
11) Tantalum	Electronics	Thailand, Brazil, Malaysia, Australia	Canada, Nigeria, Zaire	97
12) Tin	Food packaging, electrical solder	Malaysia, Bolivia, Indonesia	Australia, Brazil, Nigeria	79
13) Titanium	Missiles, aircraft airframes	United States, Japan	Great Britain	90
14) Tungsten	Armor-piercing projectiles	United States, Canada, China, Bolivia, Portugal	Peru, Zaire	50
15) Zinc	Brass ammunition, corrosion coating for steel	United States, Canada, Peru, Mexico, Australia	Zaire	62

\* United States contains some deposits of all 15 materials that could be developed in time of emergency

\*\* List of alternative sources does not include communist countries having those materials.

Source: U.S. Bureau of Mines, 1987.

TABLE 2 (Chapter III)

## LATIN AMERICAN EXTERNAL DEBT AND INFLATION

	GDP	Foreign Debt	Inflation	Urban Unemployment
Bolivia	6.0	4.5	11.0	25.5
Brazil	326.0	116.9	432.3	3.8
Chile	19.0	20.5	21.5	12.4
Colombia	36.0	15.9	24.0	11.8
Ecuador	10.6	9.6	32.5	12.6*
Mexico	127.0*	105.6	159.2	4.2
Paraguay	4.5	4.9	32.0	10.0
Peru	14.4**	15.3	2000.6***	5.6*
Uruguay	6.8	5.6	57.3	9.3
Venezuela	49.0	32.2	40.3	9.8

Data from selected countries for 1987, unless otherwise noted.  
Dollar figures in billions. Inflation data from December 86 to  
December 87.

\* Figure for 1986

\*\* Figure for 1985

\*\*\* Figure for 1988

Source: International Monetary Fund

TABLE 3 (Chapter III)

BOLIVIA  
MINING PRODUCTION

( '000 metric tons)

	1982
Tin	26.2
Lead	15.9
Zinc	47.8
Copper	2.3
Tungsten (Wolfram)	3.2
Antimony	14.2
Silver	0.2
Gold (kg pure)	1,249*
Petroleum (million barrels)	9.0
Natural gas ('000 million cu ft)	178.9

\* Source: UN Yearbook of Industrial Statistics, 1986

TABLE 4 (Chapter III)

BRAZIL  
MINING PRODUCTION

	1982
Bauxite ('000 metric tons)	6,290
Coal ('000 metric tons)	19,206
Iron ore ('000 metric tons)	119,939
Manganese ore ('000 metric tons)	2,883
Lead ('000 metric tons)	306
Dolomite ('000 metric tons)	1,954
Sea salt ('000 metric tons)	2,888
Gold (kilograms)	25,517
Silver (kilograms)	23,250
Crude petroleum ('000 cu metres)*	15,080
Natural gas (million cu metres)	3,028

\* Including natural gas liquids.

1983: Crude petroleum 19,671,541 cu metres; Natural gas 4,003.7 million cu metres.

Source: Anuario Mineral Brasileiro das Minas e Energia, 1986.

TABLE 5 (Chapter III)

CHILE  
MINING PRODUCTION

		1982
Copper (metal content)	'000 metric tons	1,255.1
Coal	'000 metric tons	997
Iron ore*	'000 metric tons	6,470
Nitrates	'000 metric tons	577
Calcium carbonate	'000 metric tons	1,667
Iodine	metric tons	2,596
Sodium sulphate (anhydrous)	metric tons	N/A
Sodium sulphate (hydrous)	metric tons	536
Molybdenum (metal content)	metric tons	20,048
Manganese**	metric tons	16,111
Gold	kilograms	16,907
Silver	kilograms	382,188
Petroleum	cubic metres	2,484,212
Natural gas	'000 cubic metres	5,064,471

\* Gross weight. The estimated iron content is 61%.

\*\* Gross weight. The metal content (in '000 metric tons) was 9.0 in 1980; 8.6 in 1981.

1983 ('000 metric tons): Copper (metal content) 1,254.7; Coal 960; Iron ore (gross weight) 7,164.

Source: UN Monthly Bulletin of Statistics)

TABLE 6 (Chapter III)

CUBA  
MINING PRODUCTION

		1983
Crude petroleum	'000 metric tons	742
Natural gas	'000 cu metres	8,300
Copper concentrates	metric tons	2,667
Nickel and cobalt	metric tons	39,257
Refractory chromium	metric tons	33,600
Salt	metric tons	179,800
Silica and sand	'000 cu metres	5,118
Crushed stone	'000 cu metres	9,849

1984: Crude petroleum 770,000 metric tons; Copper concentrates 2,700 metric tons; Nickel and cobalt 33,200 metric tons.

Source: UN Yearbook of Industrial Statistics, 1984

TABLE 7 (Chapter III)

JAMAICA  
MINING PRODUCTION

		1983
Bauxite	Crude Ore, '000 metric tons	7,531

Source: UN, Monthly Bulletin of Statistics, 1984.

TABLE 8 (Chapter III)

MEXICO  
MINING PRODUCTION

(metric tons, unless otherwise indicated)

	1983
Antimony	2,519
Arsenic	3,452
Barite	357,043
Bismuth	545
Cadmium	1,341
Copper	206,062
Crude petroleum ('000 cu m)	140,067
Fluorite	556,977
Gas (million cu m)	41,897
Gold (kg)	6,930
Graphite	44,327
Iron	5,306,343
Lead	167,405
Manganese	133,004
Selenium	24
Silver	1,911
Sulphur	1,602,029
Tin	50
Tungsten	90
Zinc	257,444

Source: UN Yearbook of Industrial Statistics, 1986

TABLE 9 (Chapter III)

PERU  
MINING PRODUCTION\*

	1983
Crude petroleum ('000 barrels)	62,452
Copper ('000 metric tons)	336
Lead ('000 metric tons)	213
Zinc ('000 metric tons)	576
Tin (metric tons)**	2,196
Iron ore ('000 metric tons)	2,873
Tungsten (metric tons)	N/A
Molybdenum (metric tons)	N/A
Silver (metric tons)	1,738
Gold (kilograms)	N/A

\* Figures for metallic minerals refer to metal content only.

\*\* Data from International Tin Council (Source: UN, Monthly Bulletin of Statistics).

Source: Ministry of Energy and Mines, 1985.

TABLE 10 (Chapter III)

VENEZUELA  
MINING PRODUCTION

Diamonds ('000 carats)	400*
Iron ore: gross weight ('000 metric tons)	11,680
metal content ('000 metric tons)	7,258*
Coal ('000 metric tons)	47
Crude petroleum ('000 metric tons)	100,391
Natural gas ('000 terajoules)	1,476

\* Provisional.

Source: UN, mainly Yearbook of Industrial Statistics, 1984.



TABLE 11 (Chapter III)

## PRODUCTION OF BAUXITE

(crude ore, '000 metric tons)

1982

World total	77,132
Latin America	17,149

## LEADING REGIONAL PRODUCERS

Brazil	4,186
Guyana*	953
Jamaica**	8,380
Suriname	3,060

## OTHER LEADING PRODUCERS

Australia***	24,690
Greece	2,853
Guinea****	11,828
Hungary	2,627
USSR*****	4,600
Yugoslavia	3,668

\* Provisional or estimated figures.

\*\* Figures refer to the dried equivalent of crude ore.

\*\*\* Twelve months ending 30 June of year stated.

\*\*\*\* Source: World Metal Statistics.

\*\*\*\*\* Estimates by the US Bureau of Mines.

TABLE 12 (Chapter III)

## PRODUCTION OF TIN CONCENTRATES

	1983
(tin content, metric tons)	
World Total*	172,900
Latin America	41,272
LEADING LATIN AMERICAN PRODUCERS	
Argentina	300**
Bolivia	25,278
Brazil	13,275
Peru	2,368
OTHER LEADING PRODUCERS	
Australia***	9,578
Indonesia	25,554
Malaysia	41,367
Thailand****	19,942

\* Estimate.

\*\* World figures are rounded to the nearest 100 tons.

Figures exclude the People's Republic of China, the Democratic People's Republic of Korea, Viet-Nam, the German Democratic Republic (GDR), the USSR, Albania and Mongolia. For 1981 Metallgesellschaft Aktiengesellschaft of Frankfurt am Main in the Federal Republic of Germany, estimated production by China and the USSR at 16,000 metric tons each, while World Metal Statistics (London) estimated the GDR's output at 1,600 tons. World totals include an estimate for Asian tin of unspecified origin (9,850) metric tons in 1982 and 16,550 in 1983).

\*\*\* Figures include the tin content of other concentrates.

\*\*\*\* Figures include the tin content of tungsten (wolfram) concentrates.

Source: International Tin Council, London.

TABLE 13 (Chapter III)

PRODUCTION OF MINERAL CONCENTRATES  
COLUMBIUM AND TANTALUM

(thousand pounds)

World Total	83,857
Latin America	70,950
LEADING LATIN AMERICAN PRODUCERS	
Brazil	70,950
OTHER LEADING PRODUCERS	
Canada	10,900
Thailand	591
Australia	410
Zaire	350
Nigeria	222
Malaysia	168

Source: Bureau of Mines, 1985.

TABLE 14 (Chapter III)

PRODUCTION OF CRUDE PETROLEUM

('000 barrels per day\*, including natural gas liquids)

	1984
World Total	58,165
Latin American	6,705
LEADING REGIONAL PRODUCERS	
Argentina	470
Brazil	490
Colombia	170
Ecuador	250
Mexico	2,955
Trinidad and Tobago	180
Venezuela	1,860
OTHER LEADING PRODUCERS	
Canada	1,670
China, People's Republic	2,120
Iran	2,180
Saudi Arabia**	4,970
USSR	12,260
United Kingdom	2,660
USA	10,400

\* Figures are rounded to the nearest 5,000 b/d.

\*\* Including an equal share of production from the Neutral Zone with Kuwait.

Source: Royal Dutch/Shell Group.

TABLE 15 (Chapter III)

STRATEGIC MINERALS  
U.S.-LATIN AMERICAN TRADE

Country	Major Commodities for Export	Potential for increased trade with the U.S.
Bolivia	Tin ore, tungsten	Very high
Brazil	Manganese, tin, bauxite, columbium tantalum, titanium, common silicon	Very high
Chile	Manganese	Very high
Cuba	Cobalt, nickel, chromium, manganese zinc	Very high
Jamaica	Bauxite	High
Mexico	Platinum, zinc, manganese, petroleum	Very high
Peru	Tin, tungsten, zinc	High
Venezuela	Bauxite, nickel, zinc, petroleum	Very high

TABLE 16 (Chapter III)

GLOBAL RESOURCE AVAILABILITY

RESOURCE	<u>YEARS AVAILABLE AT PRESENT GROWTH RATE*</u>
ALUMINUM	31
CHROMIUM	95
COAL	111
COBALT	60
COPPER	21
GOLD	9
IRON	93
LEAD	21
MANGANESE	46
MERCURY	13
MOLYBDENUM	34
NATURAL GAS	22
NICKEL	53
PETROLEUM	20
PLATINUM GROUP**	47
SILVER	13
TIN	15
TUNGSTEN	28
ZINC	18

\* The number of years that known global reserves will last with consumption growing exponentially at the average annual rate of growth.

\*\* The platinum group metals are platinum, palladium, iridium, osmium, rhodium, and ruthenium.

Source: D. Meadows, D. Meadows, J. Randers and W. Behrens, The Limits to Growth: A Report for the Club of Rome's Project on the Predicament of Mankind 56-60 (1972).